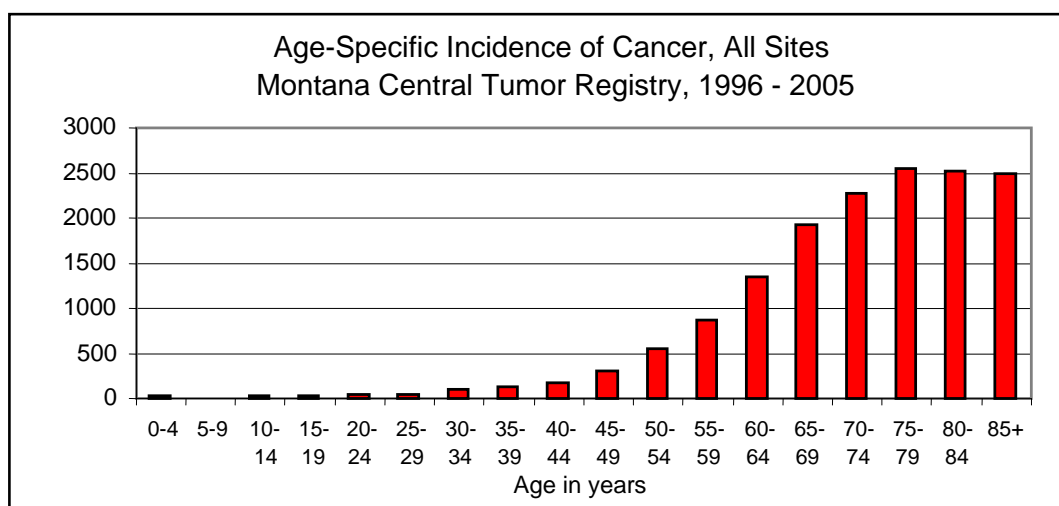


## Quarterly Surveillance Report Special Supplement February, 2008

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### Childhood Cancer

Cancers are usually diseases of middle age and older. The incidence of most types of cancer increases sharply after age 50. In Montana and in the US as a whole, approximately 1% of cancers occur in patients younger than age 20.<sup>1,2</sup> Although childhood cancers are uncommon, they account for a substantial proportion of childhood deaths nationally: 8% of deaths among children under age four, 15% of deaths among children age five to nine, 12% of deaths among children age 10 to 14, and 6% of deaths among children age 15 to 19. In Montana, there were no deaths from cancer among children under age 10 in 2005; cancer accounted for 13% of deaths among children age 10 to 14 and for 7% of deaths among children age 15 to 19.<sup>3</sup>



The most common childhood cancers are leukemia (25% of cases of cancer in children under age 20), brain and central nervous system (17%), lymphoma (16%), bone (6%), neuroblastoma (5%), kidney (4%), and retinoblastoma (2%).<sup>2,4</sup> Within these broad categories, specific subtypes account for most childhood cancers: Most childhood leukemias are acute lymphocytic leukemia (76%) or acute myeloid leukemia (13%). The majority of childhood lymphomas are Hodgkin lymphoma (57%). Most childhood bone cancers are osteosarcoma (55%) or Ewing sarcoma (34%). Nearly all childhood kidney cancers are Wilms' Tumor (95%).<sup>2,4</sup>

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<sup>1</sup> Montana Central Tumor Registry, 1996-2005

<sup>2</sup> National Cancer Institute, <http://seer.cancer.gov/publications/childhood/>

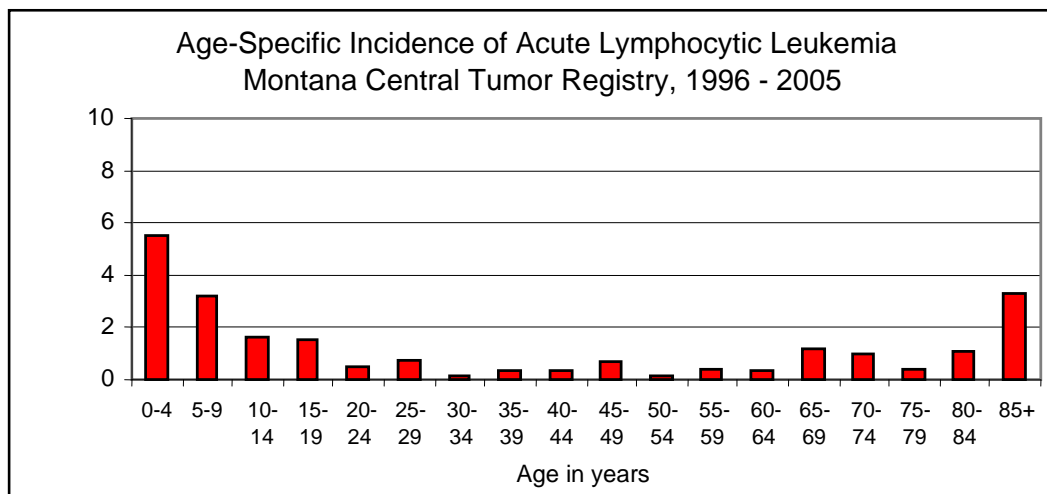
<sup>3</sup> Montana Office of Vital Statistics Annual Report 2005.

<sup>4</sup> Ross JA and Spector LG. 2006. Cancers in Children. In Schottenfeld D and Fraumeni JF, eds. *Cancer Epidemiology and Prevention*, 3rd ed. New York: Oxford University Press.

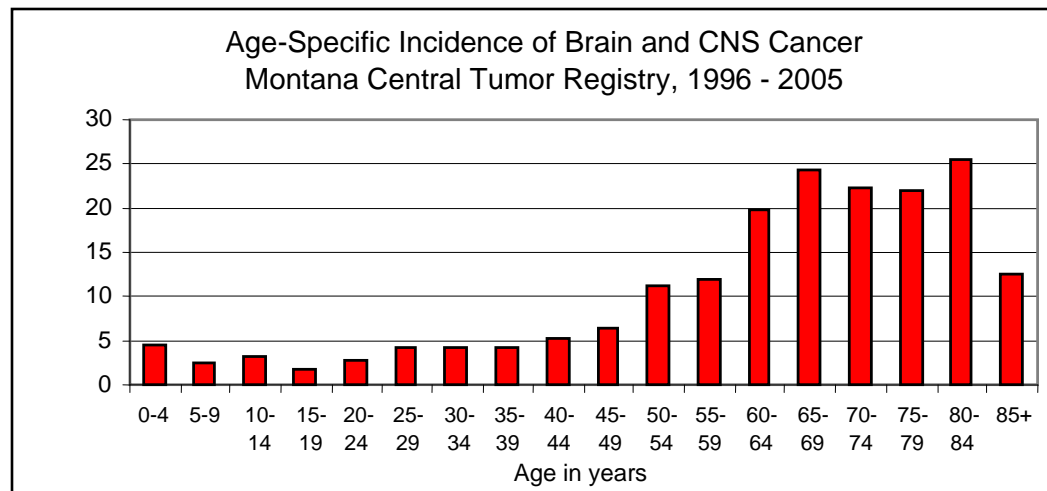
## Montana Cancer Control Section

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Although most cancers are rare in children, a few are actually more common among children or teens than adults. The most striking example of this is acute lymphocytic leukemia, which is most common among children under age five and relatively common through age 19. Only among individuals age 85 and older does the incidence rate approach that of children. Even though most cases of acute lymphocytic leukemia occur in children under age five, the age-specific incidence rate is still only 5.5 per 100,000 in this age group in Montana, and the total population incidence rate is only 1.2 per 100,000.

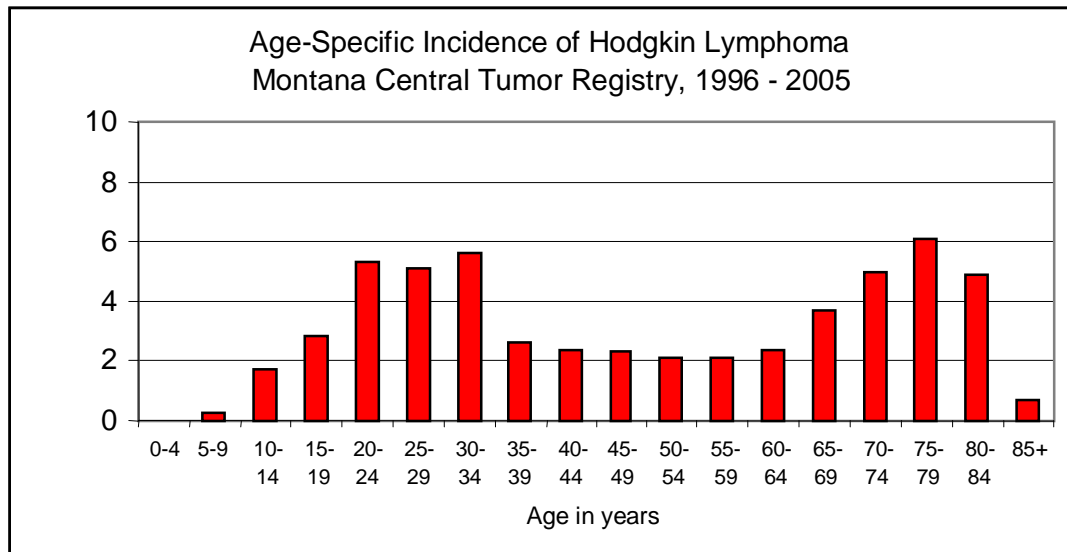


The age distribution of brain and central nervous system cancers looks slightly more like the general age distribution of all cancers, with incidence increasing after middle age. However, there are a substantial number of cases among children as well.

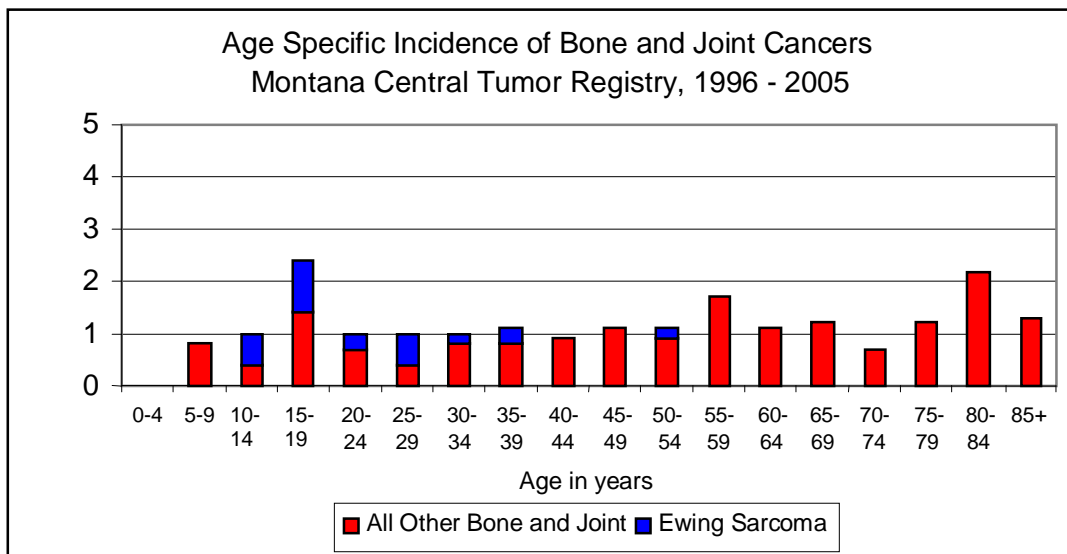


## Montana Cancer Control Section

Hodgkin lymphoma has a striking age distribution, with two peaks in age at diagnosis, the first between ages 20 and 34 and the second after age 70. Although this is not primarily a childhood cancer, there are a notable number of cases diagnosed between the ages of 10 and 19.



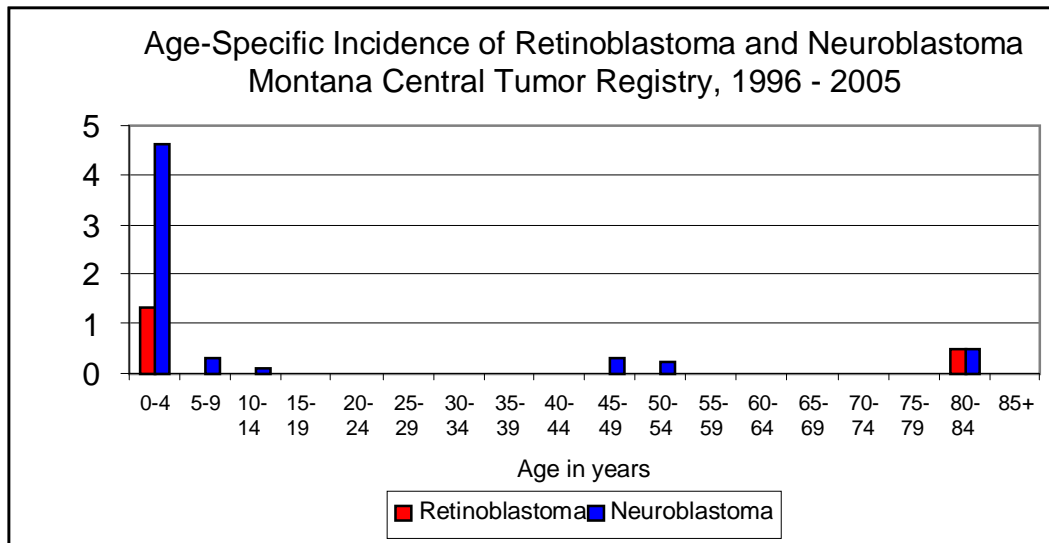
Bone cancers are uncommon at all ages but children and teenagers have incidence rates similar to those of older age groups, an unusual pattern for cancer. A particular type of bone cancer, Ewing Sarcoma, occurs most frequently among teenagers and young adults.



## Montana Cancer Control Section

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Two rare types of cancer occur almost exclusively in children: neuroblastoma and retinoblastoma. Neuroblastoma is the most common type of cancer in infants under one year of age and accounts for more than one quarter of all cancers in this age group. Retinoblastoma is also more common among infants than among older age groups.



### Causes of Childhood Cancer

Cancer usually develops over many years, as the result of cumulative action of multiple risk factors and exposures. The fundamental process of cancer initiation is a mutation in the genetic material (DNA) of cells that regulates their function and growth. Most cells in the body constantly grow and divide, making copies of their DNA, a process that has an inherent risk of error. The risk of error increases as people age and the cells of the body are less able to repair themselves. Some risk factors increase the chance of a copying error at cell division or cause damage (mutation) to the DNA of mature cells. However, cells have great capacity to repair their DNA, so most damaged cells do not become cancerous. The processes that lead to the development of cancer usually take many years. Even the most powerful risk factors that we know about, such as asbestos or industrial chemicals like benzene, usually require prolonged or repeated exposure to cause cancer. This makes childhood cancer especially perplexing.

Some childhood cancers have a strong genetic component ranging from single-gene mutations to major chromosomal aberrations.<sup>2,3</sup> Several recognized genetic syndromes

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<sup>2</sup> National Cancer Institute, *ibid*.

<sup>3</sup> Ross and Spector, *ibid*.

## Montana Cancer Control Section

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are associated with substantially increased risks of developing some types of childhood cancer. A gene specifically for retinoblastoma has been identified. However, genetic syndromes account for a small proportion of cases of childhood cancer. In the absence of a specific gene or syndrome, family history is also a risk factor for some childhood cancers, although the exact nature of the increased risk is unknown.

Therapeutic radiation and chemotherapy for a previous primary cancer are associated with increased risk of developing some childhood cancers. In the past, prenatal exposure to therapeutic or diagnostic x-rays was also a risk factor, but prenatal exposure is rare today.

There have been many investigations of parents' occupational or other exposures as risk factors for childhood cancers, and many investigations of childhood environmental exposures. These studies are difficult, partly because childhood cancers are rare and each type of cancer must be investigated individually. For example, in Montana, there were only 456 total cases of cancer in patients under age 20 between 1996 and 2005 and even the most common types were relatively rare: 72 cases of acute lymphocytic leukemia, 33 cases of Hodgkin lymphoma, and 25 cases of Wilms' Tumor of the kidney over the 10-year period.

Another difficulty in conducting studies of risk factors for childhood cancers is the problem of assessing exposures accurately. Studies must usually rely on parents' job titles or job descriptions as proxy measures for possible exposure to occupational hazards like chemicals. Studies of children's exposures to environmental hazards such as agricultural chemicals or electromagnetic fields usually rely on proxy measures like residence on a farm or near a power station. These are imprecise measures of actual exposure.

If there were real but small risks associated with these exposures, imprecise measures of exposure combined with small numbers of cases would make it nearly impossible to detect them.<sup>4</sup> If there were strong risks associated with these exposures, even small studies using proxy measures should detect them and there would be consistency among several studies. This is not the case. For each study that has found a possible risk factor associated with a particular kind of childhood cancer, there have been many studies that have failed to support those findings. Overall, the evidence falls somewhere between equivocal and negative. This could mean that the suspected risk factors do not really contribute to particular kind of childhood cancer, or it could mean that there may be a true, but very small, association.

On the whole, the consistent and unique age distributions for each type of childhood cancer observed in Montana, other states, and the US as a whole, suggest that there are genetic or developmental factors that contribute to these cancers. External causes such as environmental exposures would not produce consistent age distribution patterns repeatedly across many states.

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<sup>4</sup> MacMahon B and Trichopoulos D. 1996. *Epidemiology. Principles and Methods*. 2nd ed. New York: Lippincott Williams and Wilkins.

## Montana Cancer Control Section

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**Please visit our website at [www.cancer.mt.gov](http://www.cancer.mt.gov)**

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